Developing an Observation Protocol as a Measure of Departmental Change

J.T. Laverty, Becky Matz
Work-in-Progress Talk
September 10th, 2014
Work-in-Progress Talks

- More informal/casual
- Obtain feedback from peers
- Practice talks
- Develop methodologies
- Other?
- One still open: December 3rd
Post-Doc Group

- Build community between disciplines.
- Who are all of the DBER/Sci Ed post-docs?
- What is the form of this community?
- What would people be interested in?
Developing an Observation Protocol as a Measure of Departmental Change

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Outline

- The Transformation Project
- Three-Dimensional Learning Observation Protocol (3D-LOP)
- Open Questions
- Discussion
Discipline-Based Education Research

“DBER and related research have not yet prompted widespread changes in teaching practice among science and engineering faculty. Strategies are needed to effectively promote the translation of findings from DBER into practice.”
Introductory Courses

“The first two years of college are the most critical to the retention and recruitment of STEM majors.”
The goal of this program is “to improve the quality of undergraduate teaching and learning in science, technology, engineering, and mathematics (STEM) fields.”

Eight project sites
The “AAU Project”

- Creating a coherent STEM gateway at Michigan State University
  - STEM Alliance
  - STEM Gateway Fellowship
  - Disciplinary Discussions
Disciplinary Discussions

Engaging faculty in discussions of core ideas and practices promotes change

Changes in classroom instruction

Changes in assessments
Goals

How do we measure success?
Goals

Three Dimensional Learning

Scientific Practices

Crosscutting Concepts

Disciplinary Core Ideas

Assessments

Instruction
Goals

Scientific Practices

Crosscutting Concepts

Disciplinary Core Ideas

Three Dimensional Learning

Assessments

Instruction
Three-Dimensional Learning Assessment Protocol (3D-LAP)

- Introduced at last STEM Alliance meeting
- Dual purpose
  - Measure change
  - Help faculty improve assessments
- Characterizes assessments by focusing on:
  - Scientific Practices
  - Crosscutting Concepts
  - Disciplinary Core Ideas
Goals

Scientific Practices → Crosscutting Concepts → Disciplinary Core Ideas

Three Dimensional Learning

Assessments → Instruction
Existing Observation Protocols

- Such as TDOP, RTOP, COPUS, etc.
- Focused on “How” the class is taught
  - What students are doing
  - What instructor is doing
  - Interactions between students and instructor
  - Student-centered
  - Active learning techniques
- Don’t tell you about “What” is being taught
Three-Dimensional Learning Assessment Protocol (3D-LOP)

"How"
1. Clicker Questions
2. Tasks
3. Interactions
4. Lecture
5. Administration
6. Miscellaneous
   - Instructor Questions
   - Students Speaking

"What"
- Scientific Practices
- Crosscutting Concepts
- Disciplinary Core Ideas
- Phenomena
Example Timeline
Coding “How”

- Two undergraduates coding each video
- 29 complete
  - 22 with > 90% agreement, anything below is reconciled
  - 28 with > 80% agreement
- Trend: Transformed -> Lower % agreement
Coding “What”

- Will be done by disciplinary experts
- Definitions are in progress
- Which is where you come in…
Scientific Practices: When to code

- Marked while students are working on a **Clicker Question** or **Task** if the question/task contains a scientific practice. May or may not be marked as part of the follow-up as per other rules.
- Marked during **Interaction** or **Lecture** if the instructor portrays the act of engaging in a scientific practice as though they were a novice.
- Never marked during **Administration**.
- May be marked during **Misc** at the discretion of the coder.
Scientific Practices: When to code

- Marked while students are working on a **Clicker Question** or **Task** if the question/task contains a scientific practice. May or may not be marked as part of the follow-up as per other rules.

- Marked during **Interaction** or **Lecture** if the instructor portrays the act of engaging in a scientific practice as though they were a novice.

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Scientific Practice Example

- Obtaining, Evaluating, and Communicating Information (?)
- Begin at 4:25
Crosscutting Concepts: When to code

- Marked while students are working on a **Clicker Question** or **Task** if the question/task contains a crosscutting concept. May or may not be marked as part of the follow-up as per other rules.
- Marked during **Interaction** or **Lecture** if the crosscutting concept is explicitly talked about or discussed.
- Never marked during **Administration**.
- May be marked during **Misc** at the discretion of the coder.
Crosscutting Concepts: When to code

- Marked while students are working on a **Clicker Question** or **Task** if the question/task contains a crosscutting concept. May or may not be marked as part of the follow-up as per other rules.
- Marked during **Interaction** or **Lecture** if the crosscutting concept is **explicitly** talked about or discussed.
- Never marked during **Administration**.
- May be marked during **Misc** at the discretion of the coder.
Crosscutting Concept Example

- Scale, proportion, and quantity (?)
- Begin at 17:05
Phenomena: When to code

- Marked while students are working on a **Clicker Question** or **Task** if the question/task contains a Phenomenon. May or may not be marked as part of the follow-up as per other rules.
- Marked during **Interaction** or **Lecture** if a phenomenon is explicitly talked about or discussed. This must be more than a passing mention.
- Never marked during **Administration**.
- May be marked during **Misc** at the discretion of the coder.
Phenomena

- Keeps track of when instructors contextualize learning for students.
- Includes demonstrations; real-world examples, images, or videos; or anything else that the students could “experience”.
- Non-idealized.
- A passing mention does not count.
Phenomena

- Keeps track of when instructors contextualize learning for students.
- Includes demonstrations; real-world examples, images, or videos; or anything else that the students could “experience”.
- Non-idealized.
- A passing mention does not count.
Phenomena Example

- Photoelectric Effect
- Begin at 51:15
Thank You
Backup Slides
Scientific Practices

1. Asking questions
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information
Crosscutting Concepts

1. Patterns
2. Cause and effect
3. Scale, proportion, and quantity
4. Systems and system models
5. Energy and matter: Flows, cycles, and conservation
6. Structure and function
7. Stability and change
Disciplinary Core Ideas

1. Essential to the study of the discipline
2. Required to explain lots of phenomena
3. Provide a way to generate new ideas and predictions
Comparison: COPUS

Comparison: 3D-LOP
Comparison: 3D-LOP

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<thead>
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<th>Class Begins</th>
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<td>Disciplinary Core Idea</td>
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Comparison: 3D-LOP

- First half of class

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Comparison: 3D-LOP

- Whole class
Comparison: COPUS vs. 3D-LOP

| Students | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 32 | 34 | 36 | 38 | 40 | 42 | 44 | 46 | 48 |
|----------|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Listening |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Individual |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Clicker Groups |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Answering Question |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Student Question |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

| Instructor | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 32 | 34 | 36 | 38 | 40 | 42 | 44 | 46 | 48 |
|------------|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Lecturing |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Real-time Writing |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Follow UP |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Pose Question |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Clicker Question |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Answering Question |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Moving/Guiding |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 1 on 1 |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Demo/Visuals |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Administration |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Waiting |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
Three-Dimensional Learning